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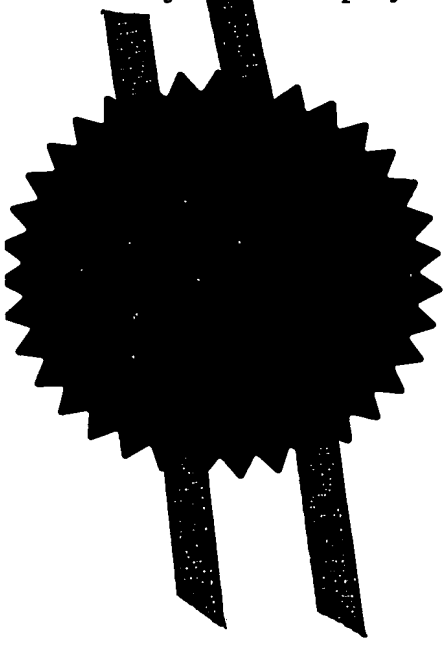

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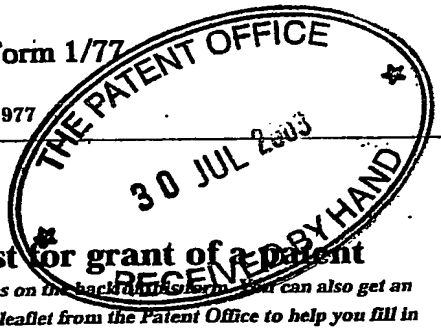

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31JUL03 E826617-5 D02890
P01/7700 0.00-0317862.1

2. Patent application number *(The Patent Office will fill in this part)* — 30 JUL 2003 0317862.1

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Biotal Industrial Products Limited
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07368095002

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation — United Kingdom

4. Title of the invention — SANITISING PRODUCT

5. Name of your agent *(if you have one)* — Gill Jennings & Every

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Broadgate House
7 Eldon Street
London
EC2M 7LH

Patents ADP number *(if you know it)* — 745002

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

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11. For the applicant
Gill Jennings & Every

I/We request the grant of a patent on the basis of this application.

Signature John Jappy Date 30 July 2003

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SANITISING PRODUCT

Field of the Invention

This invention relates to a product which prevents proliferation of microorganisms, particularly Gram-positive bacteria such as *Staphylococcus aureus*, within a space, via a vapour action, and which is active for long periods, typically several weeks. One particular use for the invention would be in waste disposal bins.

Background to the Invention

In the field of disinfection and sanitisation, there is a general move away from chemical agents, due to concerns regarding the safety and effects of these chemical compounds, or their residues, on the environment. This has led to increased interest in the use of natural compounds as disinfectants in many sectors.

The anti-microbial nature of essential oils is well documented. For example, EP 1146111 discloses a hard surface disinfecting formulation based on cinnamon oil or it's actives. The compositions are tested according to European Standard EN1276, which measures anti-microbial performance on a single occasion, and over a contact time of 5 minutes. In addition, as the application is for hard surface disinfection, the anti-microbial activity is by direct contact of the active molecules with the microbes. The use of a wipe is discussed, but no details of other carriers, or the effects of different chemistries of the wipe on anti-microbial performance are given.

WO 96/39826 describes the use of essential oil components such as cinnamic aldehyde and coniferyl aldehyde to disinfect contaminated environments, although no useful performance data for the formulations is provided in the specification.

A number of patents have also proposed essential oils and essential oil components as a replacement for the fumigant methyl bromide, for the control of plant

pathogens. WO200021364 examines the activity of essential oils from plants native to Turkey, such as *Thymbra spicata*, and although the primary targets are insects and fungi, some anti-bacterial activity is claimed, and methods for small scale, short term assessment of vapour activity of the oils are also described. Of the 70 essential oil components listed in the patent, the compound anethole was selected for further studies as a fumigant. In addition, no attempts to control the activity over a time period are described.

An area which represents a particular challenge to a disinfectant or sanitizing system is feminine hygiene waste bins, as waste contaminated with potentially pathogenic organisms is constantly being placed into the bins over period of up to 8 weeks, steadily increasing the organic matter loading and constantly adding new pathogenic bacteria, requiring disinfection. Thus, feminine hygiene waste bins provide both an application for the technology, and an ideal demonstration of the advantages and features of the invention.

Feminine hygiene waste, such as used sanitary towels and tampons, and soiled nappies and incontinence pads, are often disposed of in specialist bins, and several companies offer a service relating to these bins. Typically, the bins remain in service at the customers premises for between 2 and 8 weeks.

There is concern about the proliferation of microbes within the bin, and it is felt that this may present a hazard to the customers and operatives of the service companies, and may also lead to the development of unpleasant odours. To combat this, a biocidal system is often used in the bin. Traditionally, this has involved use of a large volume of liquid disinfectant, but this leads to an increased weight of material requiring disposal, and there are also concerns regarding the long term effectiveness of a liquid system throughout the bin once the material has been absorbed into the sanitary waste

at the base. Other systems are based on gas-generating systems which produce, for example, sulphur dioxide which can then penetrate and disinfect waste throughout the bin. There is some doubt about the control of release of the gas, as well as health and safety concerns about sulphur dioxide, which has lead to this technology being banned in a number of countries.

As mentioned above, in the field of disinfection, there is a general move away from chemical agents. Simple low volume disinfectant systems for use in bins, based on essential oils and plant extracts is the subject of EP0965 541 A2.

The bacteria used to test the performance of the vapour based products disclosed in EP0965 541 A2 were Gram-negative bacteria such as *Salmonella*, *Pseudomonas* and *Escherichia coli*. Gram-positive bacteria seem generally more resistant to natural plant extracts and essential oils. However, many Gram-positive bacteria are pathogenic. *Staphylococcus aureus* for example, can cause a number of common skin infections, and if ingested, can also cause food poisoning. In addition, the experiments reported in EP0965 541 A2 did not reflect the time interval of a bin service, and in particular, did not involve repeated experiments in the same receptacle over an extended time. A truly effective natural product for use in a feminine hygiene waste bin will need to be active against all types of bacteria, and over a time frame which accurately represents the service life of the bin, both to fulfill the role of consumer and operator protection, and to achieve regulatory approval in certain markets. Thus, improving the performance of a product against Gram-positive bacteria and controlling the activity of the product to match the service interval of the bin are major features of the present invention.

Summary of the Invention

According to one aspect of the present invention a vapour based product for sanitising and deodorising a space

such as waste disposal bin over several weeks, comprises a combination of one or more essential oil components, plus a combination of volatile and non-volatile solvents, absorbed onto a non-woven carrier.

According to a second aspect, a vapour based product for sanitising and deodorising a space such as waste disposal bin over several weeks, comprises a combination of an essential oil and an essential oil component, plus a combination of volatile and non-volatile solvents, absorbed onto a non-woven carrier.

A third aspect of a vapour based product for sanitising and deodorising a space such as waste disposal bin over several weeks, comprises a combination of one or more essential oils or essential oil components, plus a combination of volatile and non-volatile solvents, absorbed onto a cardboard "spill".

A fourth aspect of a vapour based product for sanitising and deodorising a space such as waste disposal bin over several weeks, comprises a combination of one or more essential oils or essential oil components, plus a combination of volatile and non-volatile solvents, absorbed into a piece of sintered plastic, such as polyethylene or polypropylene.

A fifth aspect of a vapour based product for sanitising and deodorising a space such as waste disposal bin over several weeks, comprises a combination of one or more essential oils or essential oil components, plus a combination of volatile and non-volatile solvents, absorbed onto silicon dioxide.

A final aspect of a vapour based product for sanitising and deodorising a space such as waste disposal bin over several weeks, comprises a combination of one or more essential oils or essential oil components, plus a combination of volatile and non-volatile solvents, thickened into a viscous gel, such as by the use of amorphous silicon dioxide.

Other carrier systems, such as powders, granules, papers and cards can also be used to deliver the active mixture, and will be obvious to those skilled in the art.

Description of the Invention

It is well established that certain essential oil components have greater anti-microbial activity than the essential oils they are derived from. Preferred essential oil components for use in this invention, which can be used singly, or in combination, include cinnamaldehyde, cinnamic alcohol and eugenol.

Such essential oil components can be absorbed onto certain carriers, such as paper, cardboard, etc., so that the vapour action of the product is controlled over a specified time period.

A further feature of the present invention is the combination of the active ingredient(s) with a blend of at least two solvents. The solvents in the mixture comprise volatile solvents such as lower alcohols, most preferably iso-propanol, and non-volatile solvents such as glycols, most preferably monopropylene glycol. The solvent mixture has two purposes. Firstly by changing the ratio of volatile to non-volatile solvents, the active life of the product can be manipulated. Higher levels of volatile solvents tend to lead to a large initial burst of anti-microbial activity, but a short active life, whilst increasing the levels of non-volatile solvents tends to slow down the rate of release of the anti-microbial vapour, and increase the active life of the product. The ratio of solvents in the current invention can vary between 10:1 and 1:10 volatile to non-volatile solvents, and more preferably between 3:1 and 1:3.

The solvents have a second effect in terms of a synergistic improvement in the anti-microbial activity of the invention. Although both iso-propanol and monopropylene glycol are reported as having anti-bacterial or anti-fungal activities, this is normally in relatively

high concentrations in a liquid system. In the present invention, a few grams of each solvent are used, which would not be expected to have a disinfecting effect in a bin of up to 50 litre volume over a 6 to 8 week period. However, when used in combination with the oils and oil fractions, unexpected synergistic effects are found, with the combination of oil fractions and or oils, plus the solvent mixture, have a much larger and longer lasting anti-microbial vapour effect than the components alone.

A further embodiment of the current invention is the synergistic effect of combinations of essential oils and essential oil components. Certain combinations of an essential oil and an essential oil component have a much greater anti-microbial effect than either component demonstrates when used alone. An example of such a mixture is the combination is cinnamon leaf oil and cinnamic alcohol. Although cinnamic alcohol is present in cinnamon leaf oil, it is not the main fraction of the oil, and is not reported to be anti-microbial. Thus increasing it's concentration in a mixture would not be expected to result in any particular increase in anti-microbial activity of the cinnamon leaf oil.

A number of carriers can be used to deliver the active ingredient/solvent mixture to the waste bin. A preferred embodiment is the use of a cellulosic fibre / plastic non-woven sheet. Once again, changing the ratio of cellulosic fibre (a polar material) and plastic (non-polar material) can have an effect on the release rate and release characteristics of the of the active ingredients, in that the polypropylene will have an attraction for non-polar molecules in the active mixture, and will tend to retain them more strongly, whilst the viscose will tend to attract non-polar materials and hold onto them more strongly. A preferred embodiment of the invention is a cellulose (wood pulp fibre)/ polypropylene non-woven material of approximately 60 g/m^2 weight, manufactured by a hydro-entanglement process, known commercially as Ahlstrom A4459.

Other suitable non-woven materials from other sources will be obvious to those skilled in the art.

A further embodiment of the invention is the use of a cardboard spill as the carrier. This is illustrated by, but not limited to a spill made of a corrugated, or solid card, and has dimensions of 40 cm by 2cm. The dimensions have been chosen so that the spill stands up across the diagonal dimensions of the bin, and is thus not buried by the waste entering the bin. The active ingredient could also be placed at one end of the spill during the manufacturing process, and if this end was then placed uppermost in the bin, it would further resist being buried by the incoming waste. Other shapes and materials which would achieve this objective would be obvious to those skilled in the art.

The carrier could also consist of a piece of sintered plastic, for example polyethylene or polypropylene. This material is manufactured in such a way that it consists of an approximately 50% void volume, and this can be filled with the active mixture, either by passive adsorption or by vacuum techniques. The shape of the material could be sheet, or a more sophisticated moulding, machining or lamination so that in some way it can be attached to inside or lid of the bin.

A further embodiment of the carrier is the use of amorphous silicon dioxide, which can absorb over 50% by weight of the active mixture, and due to the fine particle size, can deliver vapour releasing particles, each producing active ingredient throughout the bin.

Any suitable solid carrier, either organic, or inorganic, may also be used as a delivery system for the active/solvent mixture. This can include but is not limited to powders, granules, pellets, blocks, pads, sheets, etc.

A further embodiment of the invention involves delivery of the active mixture as a viscous gel. The viscosity of the active mixture can be modified by the

addition of viscosity modifying agents such as cellulose gums, anionic co-polymers etc. A preferred method for increasing the viscosity is the use of amorphous silicon dioxide, for example Aerosil 200 from Degussa AG, which can be added to the liquid in the range 1-9%, and more preferably in the range 6.5-8.5% (w/w). Other suitable viscosity modifying systems will be familiar to those skilled in the art.

The following Examples illustrate the invention.

Example 1

This example illustrates the fact that cinnamic aldehyde on a carrier can have relatively long lasting anti-microbial properties, as described in WO96/39826, but the addition of the solvent mixture increases the initial activity of the formulation, and also significantly improves the effectiveness in the long term. The solvent mixture alone starts off being very effective, but fades rapidly, and at end of the experiment, it is little better than the untreated control.

The test system consisted of a common type of feminine hygiene waste bin. One bin received 2g of monopropylene glycol and 6g of isopropanol, the second 0.5 g of cinnamic aldehyde, the third 0.75g of cinnamic aldehyde, the fourth 0.5g of cinnamic aldehyde, plus 2g of monopropylene glycol and 6g of isopropanol, the fifth 0.75g of cinnamic aldehyde, plus 2g of monopropylene glycol and 6g of isopropanol. All test solutions were absorbed onto a 20cm x 20 cm piece of a cellulose /polypropylene non woven, namely Ahlstrom AH4559. A final bin received no treatment and served as a control.

To begin the experiment, 1 ml of sterile horse serum was added to 9ml of an overnight culture of the Gram-positive organism *Staphylococcus aureus* NCTC 4163, and 20ml of this mixture was then pipetted onto 40 sterile Whatman antibiotic discs for each bin. The inoculated discs were

placed in individual compartments of Sterilin 25 compartment square Petri dishes, (Sterilin part code 103), and the lids were turned so that they were propped open. The plates were then placed in baskets approximately 15 cm above the base of the bin, and the lid placed on the bin. Following either 24, 48 or 72 hours of exposure to the product vapour (see Table), discs were removed from the trays and surviving bacteria counted by decimal dilutions in maximum recovery diluent and plating onto solidified Baird-Parker medium, which is selective for *Staphylococcus* strains, using the Miles and Misra technique. The plates were incubated overnight at 37°C, and then colonies counted on the appropriate dilution. Discs were placed into the units at time zero, after 14 days and 20 days, and the number of surviving bacteria on each disc on each occasion was calculated, and the results for the test formulations are shown below:

	Surviving bacteria on disc when discs placed in bin			
	After 0 days (72 hr exposure)	After 14 days (72 hr exposure)	After 20 days (24hr exposure)	
Control	4.0×10^7	2.4×10^6	1.4×10^7	
Solvent mixture	$<6.6 \times 10^1$	1.3×10^2	3.8×10^6	
0.5 g cinnamic aldehyde	1.9×10^3	$<6.6 \times 10^1$	3.2×10^6	
0.75g cinnamic aldehyde	5.0×10^2	$<6.6 \times 10^1$	7.1×10^5	
0.5g cinnamic aldehyde plus solvent mixture	$<6.6 \times 10^1$	$<6.6 \times 10^1$	1.7×10^5	
0.75g cinnamic aldehyde plus solvent mixture	$<6.6 \times 10^1$	$<6.6 \times 10^1$	1.3×10^4	

Example 2

To further illustrate the synergistic effects of mixtures of essential oils and essential oil components, three formulations were prepared, one containing 2g of cinnamon leaf oil, the second 1 g of cinnamic alcohol and the third both 2g of cinnamon leaf oil and 1 g of cinnamic alcohol.

The method used was the disc method described in Example 1, except that *Escherichia coli* NCTC8196 was used as the test organism, the discs were placed into the units at time zero, and they were exposed to the product vapour for 72 hours, and MacConkey agar No.3 was used for enumeration of surviving bacteria. The results for the three test formulations are shown below:

	2g cinnamon leaf oil	1g cinnamic alcohol	1g cinnamic alcohol plus 2g cinnamon leaf oil
Number of bacteria surviving on the disc	4.9×10^5	1.1×10^5	$< 6.6 \times 10^1$

This experiment clearly illustrates the fact that a combination of the essential oil and the essential oil component is considerably more effective than either constituent alone.

Example 3

A further experiment was conducted to study the effect of varying the solvent ratio in relation to the longevity of the action of the product. Various formulations were prepared, each containing 2g of cinnamon leaf oil and 1 g of cinnamic alcohol. Each formulation also contained 10 g of the solvent mixture, at varying ratios of isopropanol to monopropylene glycol.

The test system described in Example 2 was used, in that the organism used was *Escherichia coli* NCTC8196, and the agar used for growth of the organisms was MacConkey

agar No.3. In weeks zero, two, four, six and eight of the experiment, fresh inoculated discs were placed into the bins. In this example, following 24, 48 and 72 hours of exposure to the product vapour, 5 discs were removed from the trays and placed into 9 ml of nutrient broth. These broths were incubated at 37°C, and then examined for growth after 24 hours. Any broths showing growth were subsequently streaked onto MacConkey agar No.3, to test for the presence of *E. coli*. Growth on the streak was scored as a positive (i.e. surviving *E. coli* were present on the disc) and no growth as a negative (100% kill of *E. coli* on the disc). The experiment was repeated, in that fresh inoculated discs were placed into the bins at 0, 2, 4, 6 and 8 weeks after the addition of the test formulation, and the results for the varying solvent ratios are shown below:

Ratio IPA:MPG	Experiment code	0 weeks	2 weeks	4 weeks	6 weeks	8 weeks
1:3	H	All negative 48 hours	All positive 72 hours	All positive 72 hours	Not tested	Not tested
1:1	K	All negative 48 hours	All positive 72 hours	All positive 72 hours	Not tested	Not tested
3:1	V	All negative 48 hours	All negative 24 hours	All negative 48 hours	All negative 48 hours	All negative 72 hours
5:1	R	All negative 24 hours	All negative 48 hours	All negative 48 hours	Two positive 72 hours	Two positive 72 hours

The results show that at in mixtures containing predominantly monopropylene glycol, the initial performance of the product is acceptable, but the performance rapidly fades over the longer term. Increasing the proportion of iso-propanol to make an equal mixture, shows no improvement, but increasing it again to 3:1 isopropanol to monopropylene glycol, significantly improves the long term performance of the product, so that it remains active for the desired 8 weeks in the unit. By increasing the amount of iso-propanol even further, to 5:1, the initial performance is improved slightly, but the long term

performance is again less acceptable. Thus, the effect of manipulating the ratio on the long term activity of the formulation is demonstrated. A 3:1 ratio is the correct combination for a product active against this bacterium and utilizing these oils, but other oils and other active mixtures may require different proportions of volatile and non-volatile solvents, depending on the characteristics of the active mixture itself.

Example 4

A further illustration of the value of this invention over the prior art is provided in the following example. A combination of tea tree oil and silicon dioxide was described in EP0965 541 A2. This prior art formulation, consisting of 1.2 g of tea tree oil absorbed onto 3.8 g of Sipernat 22 silicon dioxide, was tested against a formulation consisting of 1.2 g of tea tree oil, 4.2 g of monopropylene glycol, 1.8 g of iso-propanol, absorbed onto 5.4 g of Sipernat 22 silicon dioxide in a jar experiment. Three jars were used for each of the two trial formulations and three jars for the control. The two products were each placed into the bottom of three jars, and sanitary towels inoculated with three test bacteria, *Salmonella typhimurium*, *Staphylococcus aureus* and *Escherichia coli*, suspended above the products in separate jars, and the jars sealed. Surviving bacteria in the towels were counted using standard microbiological methods.

Organism	Formula	1 day contact	2 day contact	7 day contact
Staphylococcus aureus	Prior art	$2.7x10^8$	$4.7x10^8$	$<3x10^3$
	Solvent formulation	$<3x10^3$	NT	NT
Salmonella typhimurium	Prior art	$3.6e8^8$	$3.7x10^8$	$<3x10^3$
	Solvent formulation	$<3x10^3$	NT	NT
Escherichia coli	Prior art	$4.5x10^8$	$2.9x10^8$	$<3x10^3$
	Solvent formulation	$<3x10^3$	NT	NT

The data from the prior art formulation is similar to that reported in EP0965 541 A2, in that bacteria numbers were reduced in around 7 days exposure to the product vapour. The increased activity of the new formulation, including solvents, is clearly shown, in that bacteria levels are reduced to below detection limits in just one day.

Example 5

One particular embodiment of the present invention involves delivering the active ingredient mixture on a sheet of non-woven fabric. Not only does this make the manufacturing process economic, and the product easy for the end user to dispense, it also improves the anti-microbial performance of the product. An active ingredient mixture, consisting of 2g of cinnamic aldehyde and 1g of cinnamon leaf oil, plus a solvent mix of 6g of monopropylene glycol and of 2g iso-propanol, was tested in a number of delivery systems. In one sanitary disposal unit, the liquid active itself was placed in a small glass beaker placed in the base of the unit, in a second unit, the active mixture was absorbed onto a 85mm x 55mm x 4mm thick pure cellulose pad, and in a third, the active was absorbed onto the preferred embodiment, a 20cm x 20 cm piece of a cellulose /polypropylene non woven, namely Ahlstrom AH4559. A fourth unit had no treatment and thus served as the control.

The test system described in Example 1 was used, i.e. *Staphylococcus aureus* bacteria on discs. In this example, the inoculated discs were placed into the units after 10 days, and exposed to the product for 48 hours before the discs were removed and surviving bacteria on each disc were enumerated. The results are shown in the following table:

Treatment	Surviving bacteria per disc after 48 hours exposure
None (control)	$3.0x10^7$
Active mix+ solvents in glass beaker	$6.2x10^6$
Active mix+ solvents of cellulose pad	$2.5x10^5$
Active mix + solvents on non-woven sheet	$7.2x10^3$

Example 6

A further embodiment of the present invention involves delivering the active ingredient mixture on a piece of cardboard. The active mixture consisted of 0.75g of cinnamic aldehyde, and the cardboard was a B flute corrugated board, and of dimensions 400mm x 20 mm x 3mm. The active mixture was absorbed onto one end of the cardboard, and this end was then placed uppermost in the unit. One sanitary disposal unit received the test system, and a second had no treatment and thus served as the control.

The test system described in Example 1 was used, i.e. *Staphylococcus aureus* bacteria on discs. In this example, the inoculated discs were placed into the units at time zero and after 14 days, and exposed to the product for 72 hours before the discs were removed and surviving bacteria on each disc were enumerated. The results are shown in the following table:

Treatment	Surviving bacteria per disc after 72 hours exposure	
	Time zero	14 days
None (control)	$2.3x10^7$	$3.1x10^7$
Active mix on cardboard spill	$1.3x10^3$	$3.2x10^4$

The results show that a cardboard spill is a further suitable method to deliver the technology.

Example 7

Further embodiments of the present invention involve delivering the active ingredient mixture on a piece of sintered polyethylene, or in a viscous gel, formed by the

addition of silicon dioxide. In each case, the active mixture consisted of 1g of cinnamic aldehyde plus a solvent mix of 6g of monopropylene glycol and of 2g iso-propanol. The sintered polyethylene was of dimensions 100mm x 80 mm x 3mm, and had an average pore size of 100μm and a void volume of approximately 40%. The gel was created by adding 6.5% Aerosil 200, a fumed silicon dioxide produced by Degussa, to the liquid preparation. One sanitary disposal unit received the sintered plastic system, one the gel, and the third unit had no treatment and thus served as the control.

The test system described in Example 1 was used, i.e. *Staphylococcus aureus* bacteria on discs. In this example, the inoculated discs were placed into the units at time zero and after 14 days, and exposed to the product for 72 hours before the discs were removed and surviving bacteria on each disc were enumerated. The results are shown in the following table:

Treatment	Surviving bacteria per disc after 72 hours exposure	
	Time zero	14 days
None (control)	$2.3x10^7$	$3.1x10^7$
Active mix in sintered plastic	$<6.6x10^1$	$<6.6x10^1$
Active mix in viscous gel	$<6.6x10^1$	$1.5x10^5$

The results show that both embodiments are suitable ways of delivering the technology. Indications from these un-optimised systems are that the sintered plastic is slightly more effective than the viscous gel.

Example 8

A further illustration of the value of the current invention over the prior art is provided below. An active ingredient mixture, consisting of 4g of cinnamic aldehyde and a solvent mix of 6g of monopropylene glycol and of 2g iso-propanol, absorbed onto a 20cm x 20 cm piece of Ahlstrom AH4559 was tested against a formulation containing

1.2 g of tea tree oil absorbed onto 3.8 g of Sipernat 22 silicon dioxide, as described in EP0965 541 A2.

The test system described in Examples 1 and 5 was used, i.e. *Staphylococcus aureus* NCTC 4196 bacteria on discs. In this example, inoculated discs were placed into the units at time zero, and after 4 and 8 weeks, and exposed to the product vapour for 72 hours on each occasion, before the discs were removed and the number of surviving bacteria per disc enumerated. The results are shown in the following table:

Treatment	Surviving bacteria per disc after 72 hours exposure		
	Time zero	4 weeks	8 weeks
Prior art (tea tree oil and silicon dioxide)	$3.6x10^5$	$1.6x10^7$	$4.1x10^7$
Present invention (cinnamic aldehyde + solvents on a non-woven sheet)	$<6.6x10^1$	$<6.6x10^1$	$<6.6x10^1$

The fact that significant anti-microbial results, were obtained, against a Gram positive bacterium over an 8 week period, clearly illustrates the value of the invention over the prior art.

CLAIMS

1. A vapour producing formulation for disinfecting a space comprising one or more essential oil components, and a mixture of volatile and non-volatile solvents absorbed on a carrier.

2. A formulation according to claim 1, wherein the essential oil component is cinnamic aldehyde.

3. A formulation according to claim 1, wherein the essential oil component is cinnamic alcohol.

4. A formulation according to claim 1, wherein the essential oil component is eugenol.

5. A vapour producing formulation for disinfecting a space comprising one or more essential oils and a mixture of volatile and non-volatile solvents, absorbed on a carrier.

6. A formulation according to claim 5 wherein the essential oil is tea tree oil.

7. A formulation according to claim 5, wherein the essential oil is cinnamon leaf oil.

8. A vapour producing formulation for disinfecting a space comprising one or more essential oils as defined in any preceding claim, one or more essential oil components as defined in any preceding claim, and a mixture of volatile and non-volatile solvents, absorbed on a carrier.

9. A formulation according to any preceding claim where the volatile solvent is iso-propanol.

10. A formulation according to any preceding claim where the non-volatile solvent is monopropylene glycol.

11. A formulation according to any preceding claim where the ratio of volatile to non-volatile solvents is in the ratio 10:1 to 1:10.

12. A formulation according to any preceding claim wherein carrier is a non-woven material.

13. A formulation according to any preceding claim where the non-woven carrier is a combination of cellulose and polypropylene.

14. A formulation according to claims 1-11 wherein the carrier is a cardboard spill.

15. A formulation according to claims 1-11 wherein the carrier is sintered plastic.

16. A formulation according to claims 1-11 wherein the carrier is amorphous silicon dioxide.

17. A vapour producing formulation for disinfecting a space comprising one or more essential oil components as defined in any preceding claim, and a mixture of volatile and non-volatile solvents as defined in any preceding claim in a viscous liquid.

18. A vapour formulation for disinfecting a space comprising one or more essential oils as defined in any preceding claim, one or more essential oil components as defined in any preceding claim, and a mixture of volatile and non-volatile solvents as described in any preceding claim, in a viscous liquid.

19. A formulation according to claims 17-18 where the viscosity is modified by addition of silicon dioxide.

20. A formulation according to any previous claim where the space to be disinfected is a waste disposal bin.

21. Use of a formulation according to any preceding claim to sanitise and deodorise a waste disposal bin.

ABSTRACT

A formulation to reduce the numbers of bacteria, particularly Gram positive bacteria, in a space such as a waste disposal bin, via the vapour phase, and active over a long period, typically several weeks. The product comprises one or more essential oils or essential oil components plus a mixture of volatile and non-volatile solvents, on a carrier such as a non-woven, sintered plastic or cardboard.